

- 1 1. An integrated motor and magnetic bearing, comprising:
2 a rotor comprising a plurality of permanent magnets; and
3 a stator comprising a plurality of independently controlled coil segments magnetically
4 coupled to said permanent magnets.
- 5 2. An integrated motor and magnetic bearing as claimed in claim 1, said coil segments
6 comprising a plurality of coil phases.
- 7 3. An integrated motor and magnetic bearing as claimed in claim 1, further comprising a
8 first radial position sensor disposed in or adjacent to a clearance gap between said rotor and said
9 stator for sensing the position of said rotor with respect to said stator along a first axis, and a
10 second radial position sensor disposed in or adjacent to said clearance gap between said rotor and
11 said stator for sensing the position of said rotor with respect to said stator along a second axis.
- 12 4. An integrated motor and magnetic bearing as claimed in claim 1, said integrated motor
13 and magnetic bearing capable of providing simultaneously both rotational torque and radial
14 bearing force.
- 15 5. An integrated motor and magnetic bearing as claimed in claim 1, said integrated motor
16 and magnetic bearing permitting dynamic application of rotational torque and/or radial force.
- 17 6. An integrated motor and magnetic bearing as claimed in claim 1, said integrated motor
18 and magnetic bearing capable of providing rotational torque and/or radial bearing force.
- 19 7. An integrated motor and magnetic bearing as claimed in claim 1, wherein at least one
20 said sensor is selected from the group consisting of: an encoder, a Hall effect transistor, and a
21 device adapted to measure a voltage generated at at least one said coil segment.
- 22 8. An integrated motor and magnetic bearing as claimed in claim 1, said integrated motor
23 and magnetic bearing operating as a DC device.

1 9. An integrated motor and magnetic bearing as claimed in claim 1, wherein said clearance
2 gap is sized so as to provide vibration isolation.

3 10. An integrated motor and magnetic bearing as claimed in claim 1, wherein at least one
4 redundant coil segment is provided for fault tolerance.

5 11. An integrated motor and magnetic bearing as claimed in claim 1, wherein said integrated
6 motor and magnetic bearing is adapted to provide off axis-operation and/or run-out cancellation.

7 12. An integrated motor and magnetic bearing as claimed in claim 3, further comprising a
8 controller receiving input from at least one said sensor and, based on said at least one input,
9 controlling the current delivered to at least one said coil segment.

10 13. An integrated motor and magnetic bearing as claimed in claim 12, wherein said controller
11 is adapted to permit off-axis positioning.

12 14. An integrated motor and magnetic bearing as claimed in claim 1, wherein said rotor has a
13 toothless configuration.

14 15. An integrated motor and magnetic bearing as claimed in claim 1, further comprising a
15 thrust bearing adapted to provide axial thrust.

16 16. An integrated motor and magnetic bearing as claimed in claim 1, wherein said rotor and
17 said stator are configured such that the attraction of said rotor to said stator provides axial thrust.

18 17. An integrated motor and magnetic bearing as claimed in claim 1, wherein said plurality
19 of coil segments is at least three coil segments.

20 18. An integrated motor and magnetic bearing as claimed in claim 2, wherein said plurality
21 of coil phases is at least two coil phases.

22 19. An apparatus for manipulating a shaft comprising:

1 two integrated motor and magnetic bearing assemblies, each said assembly comprising a
2 rotor and a stator, each said rotor comprising a plurality of permanent magnets, and each said
3 stator comprising a plurality of independently controlled coil segments magnetically coupled to
4 said permanent magnets; and

5 a shaft;

6 wherein each said assembly is disposed along said shaft.

7 20. An apparatus as claimed in claim 19, further comprising an independent control device
8 for each said assembly, thereby allowing independent movement of the shaft with respect to each
9 said assembly.

10 21. An apparatus as claimed in claim 20, wherein said control devices are adapted to permit
11 warping or off-axis pointing through the axial plane by independent positioning of the suspended
12 shaft in each said assembly.

13 22. An apparatus as claimed in claim 20, wherein said control devices are adapted to permit
14 rotation of said shaft off the central axis.

15 23. An apparatus as claimed in claim 19, further comprising a thrust bearing adapted to
16 provide axial thrust.

17 24. An apparatus as claimed in claim 20, wherein at least one said rotor and at least one said
18 stator are configured such that the attraction of said rotor to said stator provides axial thrust.

19 25. A method for providing integral electromagnetic motor and bearing functions
20 comprising:

21 sensing a first radial position of a rotor, said rotor comprising a plurality of permanent
22 magnets, with respect to a stator along a first axis, said stator comprising a plurality of
23 independently controlled coil segments magnetically coupled to said permanent magnets;

1 sensing a second radial position of said rotor with respect to said stator along a second
2 axis; and
3 delivering current to at least one said coil segment, the amount of said current based on at
4 least one said sensed position.

26. A method as claimed in claim 25, further comprising providing axial thrust along a third axis, said third axis crossing the plane of said first and said second axes.

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Station	Time	Lat	Long	Alt	Temp	Hum	Wind	Dir	Speed	Pressure	Clouds	Remarks
1000	0000	33° 30' N	150° 00' W	10	10.0	100	10	10	10	10.0	10	10.0
1001	0100	33° 30' N	150° 00' W	10	10.0	100	10	10	10	10.0	10	10.0
1002	0200	33° 30' N	150° 00' W	10	10.0	100	10	10	10	10.0	10	10.0
1003	0300	33° 30' N	150° 00' W	10	10.0	100	10	10	10	10.0	10	10.0
1004	0400	33° 30' N	150° 00' W	10	10.0	100	10	10	10	10.0	10	10.0
1005	0500	33° 30' N	150° 00' W	10	10.0	100	10	10	10	10.0	10	10.0
1006	0600	33° 30' N	150° 00' W	10	10.0	100	10	10	10	10.0	10	10.0
1007	0700	33° 30' N	150° 00' W	10	10.0	100	10	10	10	10.0	10	10.0
1008	0800	33° 30' N	150° 00' W	10	10.0	100	10	10	10	10.0	10	10.0
1009	0900	33° 30' N	150° 00' W	10	10.0	100	10	10	10	10.0	10	10.0
1010	1000	33° 30' N	150° 00' W	10	10.0	100	10	10	10	10.0	10	10.0
1011	1100	33° 30' N	150° 00' W	10	10.0	100	10	10	10	10.0	10	10.0
1012	1200	33° 30' N	150° 00' W	10	10.0	100	10	10	10	10.0	10	10.0
1013	1300	33° 30' N	150° 00' W	10	10.0	100	10	10	10	10.0	10	10.0
1014	1400	33° 30' N	150° 00' W	10	10.0	100	10	10	10	10.0	10	10.0
1015	1500	33° 30' N	150° 00' W	10	10.0	100	10	10	10	10.0	10	10.0
1016	1600	33° 30' N	150° 00' W	10	10.0	100	10	10	10	10.0	10	10.0
1017	1700	33° 30' N	150° 00' W	10	10.0	100	10	10	10	10.0	10	10.0
1018	1800	33° 30' N	150° 00' W	10	10.0	100	10	10	10	10.0	10	10.0
1019	1900	33° 30' N	150° 00' W	10	10.0	100	10	10	10	10.0	10	10.0
1020	2000	33° 30' N	150° 00' W	10	10.0	100	10	10	10	10.0	10	10.0
1021	2100	33° 30' N	150° 00' W	10	10.0	100	10	10	10	10.0	10	10.0
1022	2200	33° 30' N	150° 00' W	10	10.0	100	10	10	10	10.0	10	10.0
1023	2300	33° 30' N	150° 00' W	10	10.0	100	10	10	10	10.0	10	10.0
1024	0000	33° 30' N	150° 00' W	10	10.0	100	10	10	10	10.0	10	10.0
1025	0100	33° 30' N	150° 00' W	10	10.0	100	10	10	10	10.0	10	10.0
1026	0200	33° 30' N	150° 00' W	10	10.0	100	10	10	10	10.0	10	10.0
1027	0300	33° 30' N	150° 00' W	10	10.0	100	10	10	10	10.0	10	10.0
1028	0400	33° 30' N	150° 00' W	10	10.0	100	10	10	10	10.0	10	10.0
1029	0500	33° 30' N	150° 00' W	10	10.0							